CONTROLLER-PILOT DATALINK COMMUNICATION[1]

(CPDLC)

User Interface for Air Traffic Controllers Used to Communicate with Pilots (specified by FAA)

Benefits

CPDLC will allow pilots and controllers to transmit digital data messages directly between computers on the ground and computers on board the aircraft. In the future, this will alleviate frequency congestion problems and allow the controller to handle more traffic. Significant reduction of response time and improvement in weather deviation request responses have already been achieved in the South Pacific.

[1] Adaptado de http://www.aviationmanuals.com/articles/article4.html

One of the most important aspects of this technology is its intended reduction of crew-input errors. The crew can downlink a complex route clearance request, which the controller can re-send when approved without typing all the coordinates. This technology also reduces pilot/controller workload by allowing the FMS to automatically downlink a report such as a waypoint crossing. This helps both the flightcrew and the controller.

As mentioned, CPDLC is intended to increase safety by reducing communication errors and pilot workload, improving the efficiency of airspace management and providing economic benefits. Therefore, if more operators are equipped, the cost/benefit will improve. Use of CPDLC in Pacific oceanic airspace is currently optional. In the future, however, CPDLC could be considered a requirement for certain designated routes.

Brief background

Conceptual design for the Future Air Navigation System (FANS) is based on the use of satellite technology to manage air traffic. Since the 1991 ICAO endorsement of CNS/ATM, the FANS committee has actively worked with member States to explain and refine the economic necessity and benefits of installing new CNS/ATM technology.

The FANS Interoperability Team (FIT) was formed in 1997 as an international panel of operational and technical specialists. The team is actually a sub-group of the Informal South Pacific ATS Coordinating Group that brings together airline operators, ATS units, airframe and avionics manufacturers and datalink service providers. FIT has resolved many technical problems and has been instrumental in the standardization of international datalink procedures.

South Pacific FANS operating experience shows that considerable benefit derives from close monitoring of the end-to-end system performance. This function is performed by the FIT Central Monitoring Agency, which acts much like the Central Monitoring Agency in the UK for the NAT RVSM airspace.

The general consensus is that without the work of this group, the future of FANS and the whole concept of CNS/ATM would not have progressed as it has. FIT is now being used as a model for the creation of a similar group for the European Preliminary Eurocontrol Trials in Air/Ground Datalink program.

Operational overview

ATS systems will use Field 10 (equipment) of the ICAO flight plan to identify an aircraft's datalink capability. Pilots will use the letter "J" in Field 10 and the characters "DAT/" should be placed in Field 18, followed by one or more letters to indicate the type of datalink equipment carried (e.g., "S" for satellite datalink, "H" for HF datalink, etc.) once they receive operational approval. An initial ATS Facilities Notification (AFN) logon must occur and can be initiated by the pilot on the ground before departure. Initial AFN logon must also occur when the aircraft arrives from an area where CPDLC is not provided.

CPDLC uses the concept of Data Authority. There can only be two Data Authorities (maximum of two ATS units) connected to the aircraft for CPDLC at any one time, with only one of these connections (Current Data Authority) being active. Unlike Automatic Dependent Surveillance (ADS), CPDLC requires flightcrew interaction. The flightcrew is aware of which ATS unit has the active connection and they actively use the functionality to send response messages and reports. They are also aware of the hand-off from one ATS unit to another. Workload and integration with other tasks will be critical to situational awareness.

The next FIR on the cleared route is known as the Next Data Authority (NDA). If an NDA message is not received by the aircraft, the NDA does not exist and termination of the connection with the current Data Authority will leave the aircraft without CPDLC connectivity. If the next ATS unit is not datalink-equipped, an NDA message is not sent to the aircraft. Prior to reaching the next FIR, the crew is instructed to establish voice contact with the next ATS unit. The End Service message sent by the Current Data Authority will terminate the active connection and the aircraft will not be CPDLC connected with any ATS unit until the pilot performs an initial logon to a datalink ATS unit.

An initial logon, which is the pilot's responsibility, should occur somewhere between 15 and 45 minutes prior to the aircraft's boundary estimate. When the pilot performs the initial logon to an ATS unit, that unit becomes the Current Data Authority. A successful logon is required for CPDLC.

FMS display

Currently on the Boeing 747-400 FANS-1 FMS display, the ATC LOGON/STATUS page is accessed by selecting the ATC button if no connections currently exist. To perform an initial logon manually, the pilot types the four-letter ICAO designator for the ATS unit. The pilot then selects the LOGON TO button to move the designator to where the four boxes are displayed. The pilot then enters the flight number and selects the FLT NO button. This action moves the flight number into the appropriate position and then activates a SEND button at the top right of the display. On selection, the pilot will see LOGON SENDING then LOGON SENT and finally LOGON ACCEPTED. Aircraft registration number and flight number must be the same as those on the flightplan. Examples of uplink messages that arm the avionics to perform functions automatically are REPORT REACHING (level) and REPORT PASSING (position). When one of these messages is received by the avionics, the flightcrew is presented with the ARM prompt on the UPLINK and VERIFY REPORT pages of the FMS. Selecting the ARM prompt on either page will arm the report for transmission. The avionics will automatically send the downlink report message when the event occurs.

Procedural issues

CPDLC involves new satellite communication systems, new or modified flightdeck systems, new pilot, dispatcher and controller procedures and knowledge, and new aircraft maintenance practices and procedures. All of these will require standardized procedures and practices. Currency requirements include a recommendation that pilots use CPDLC operationally within 30 days of initial training. In addition, the pilot should use CPDLC operationally or receive follow-on training at least every 60 days. Computer-based training can be used as an option to meet this requirement.

Preflight procedures include NOTAM reviews for planned and predicted outages. HF voice capability still remains a requirement and must be monitored even when CPDLC is being used for position reports and clearances. Operators must comply with the voice communications procedures associated with CPDLC. Communications initiated with ATS by voice should be completed by voice and communications initiated by CPDLC should be completed, whenever possible, by CPDLC.

A clear understanding of the CPDLC logon, connection, failure and closure modes is required to develop acceptable flightcrew procedures and training programs. It is essential that operators understand the very significant differences in pilots' listening to, understanding and reading back an ATC clearance issued by voice and pilots' receiving a text message, reading it precisely and understanding and complying with it. Transition to CPDLC challenges our current approach to understanding situational awareness. Human factors activities are being included in the CPDLC schedule.